FIG. 1a

PROG. VOLTAGE CONTROLLER 30

PROG. VOLTAGE CONTROLLER 46a

WRITER INTERFACE 32

PROG. VOLTAGE 50

RENDER 39

MIP 38

RIP 37

LOGIC AND CONTROL UNIT 24

DATA SOURCE 36

TONER AUGER 42

REPL. MOTOR 41

REPL. MOTOR CONTROL 43

TO S₁

V_{grid}

V_B

D_{out}

10

28

48

49

46

46b

S

18

18a

21f

21g

21e

21b

20

21a

110

34a

34

S₁

35a

21b

21d

21c

35

57

76

P

40

FIG. 1b

10

Marking Engine

Render 39

36

NT WORKSTATION

SCSI

SCANNER

One or the other

New with Software

Ver. 3.15

FE LAPTOP

Private or Maintenance Network

HUB or SWITCH

CUSTOMERS LAN

Public Network

Visible on User Interface

MIP 38

RIP 37

Algorithm Block Diagram

Thinning/Thickening Mode

Interior Pixel Value
Edge Pixel Value
1 Pixel Wide Value
2 Pixel Wide Value

IPV
EPV
1PV
2PV

From RIP
1 bit
310

1 to 8 bits Converter
312

8 bit
316

3x3 Laplacian

8 bit Edge Information
317

314

3x3 DIR LUT
8 bit D
323

322
320

1 & 2 pixel wide detect
8 bit
321
1 or 2

8 bit Original Image Data

Map
A
B
C

318
4 bit
340

To Writer Interface

338
330
332
334
336

39

FIG. 2

FIG. 3

PIQ

S

NE

N

SW

E

SE

W

NW
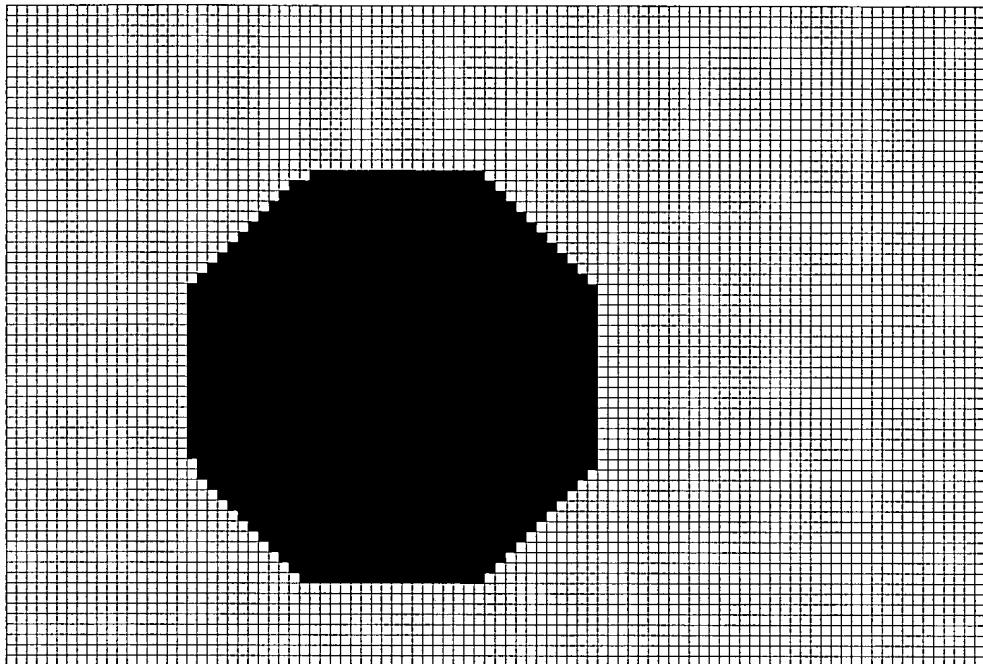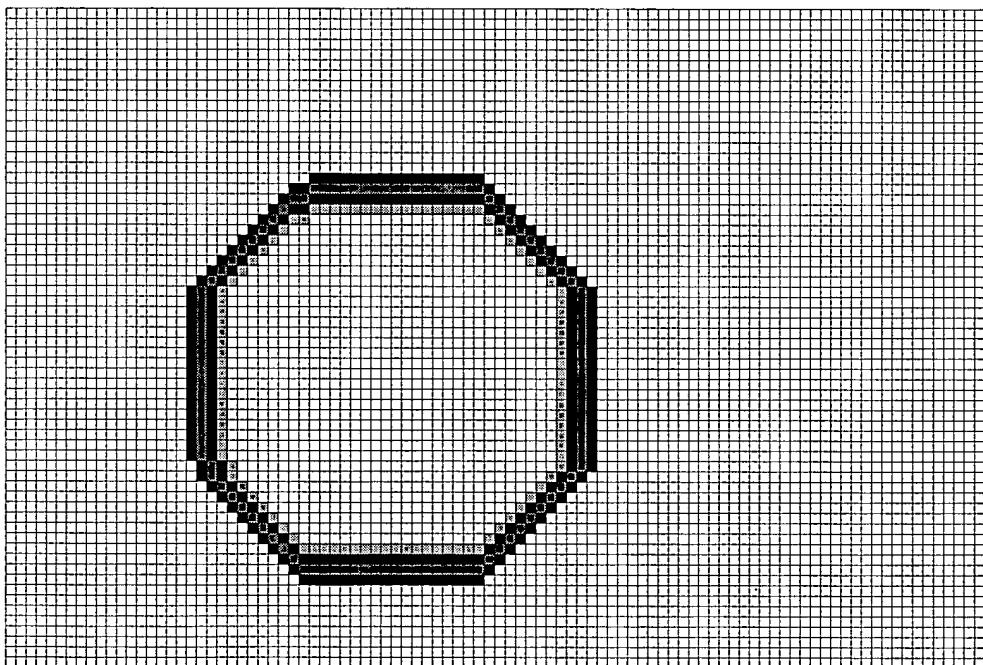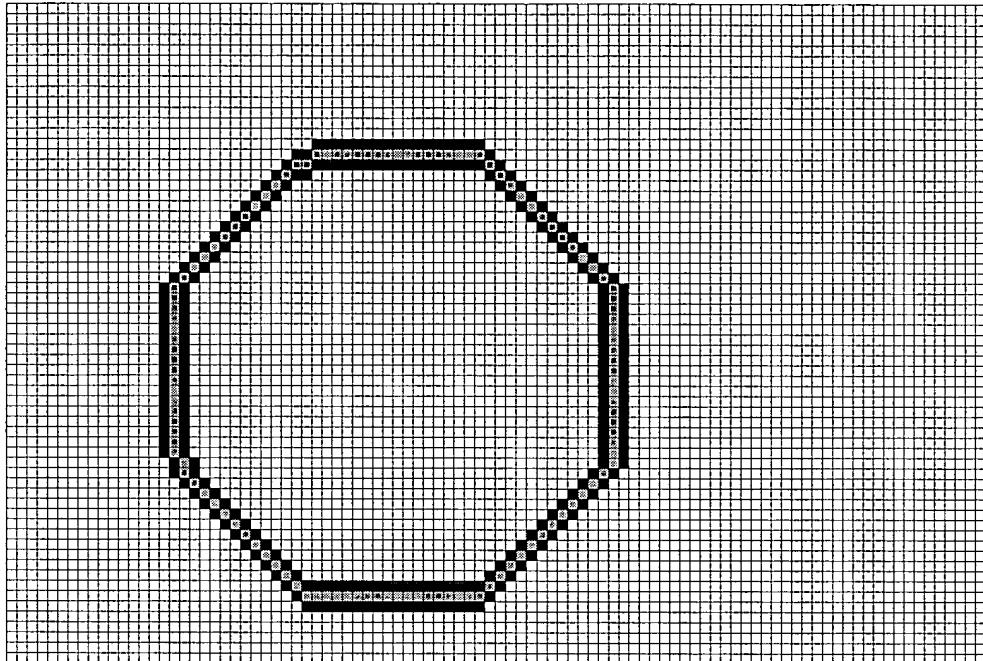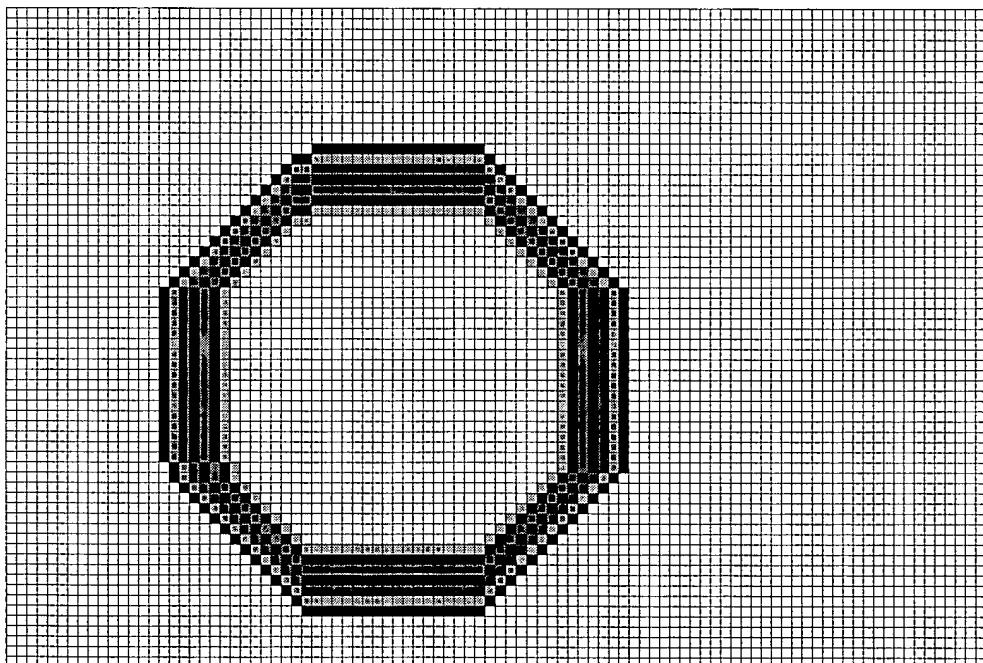
FIG. 4

Fig. 5a
Original object bitmap

Fig. 5b
Four onion skin layers
when thinning

Figure 5c
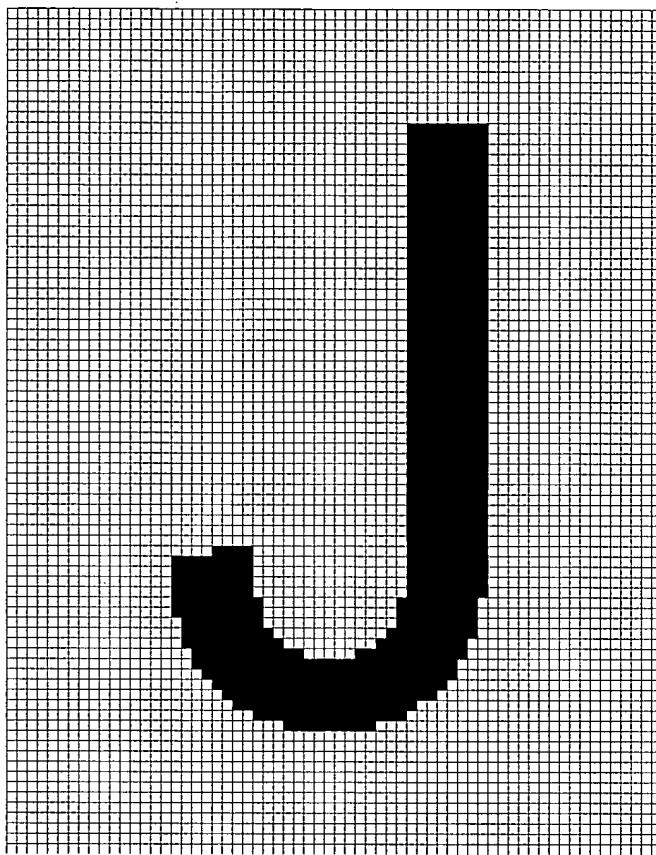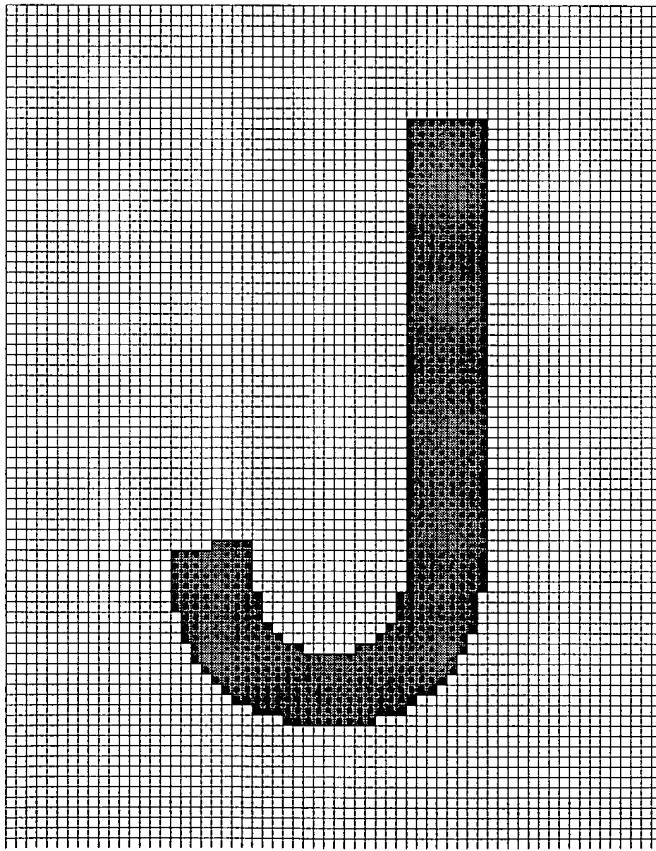Three onion skin layers
when thickening

Fig. 5d
All layers
(thickening and thinning)

Fig. 6a
Original

Fig. 6b
Same grey pixel value
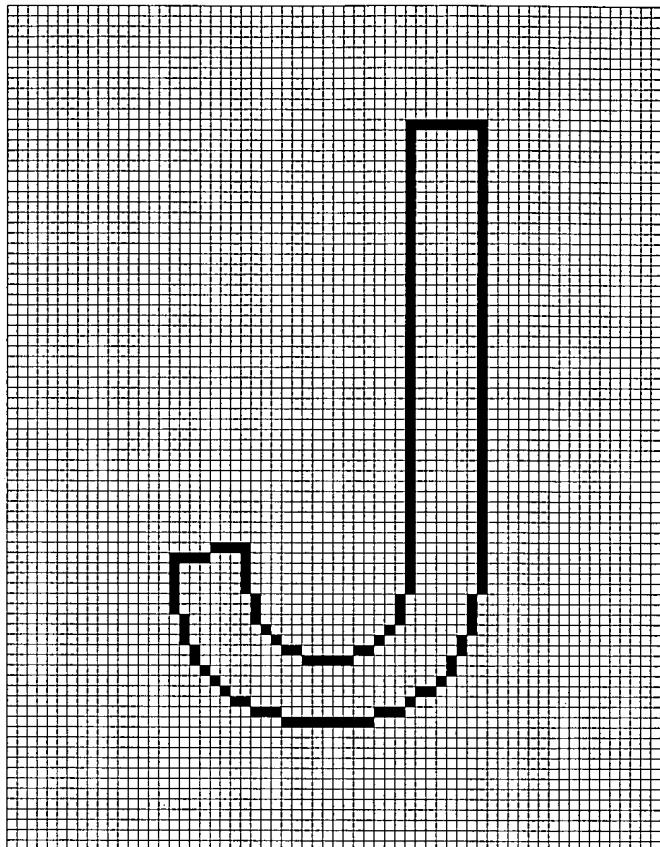assigned to edges and
solid area density
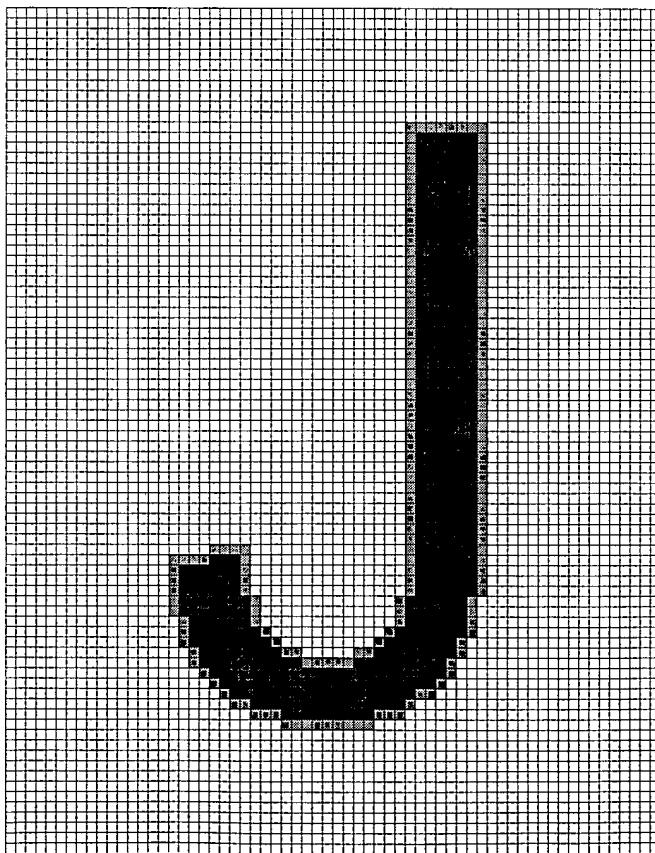
Fig. 6c
Edges when
thinning

Fig. 6d
Lightened -
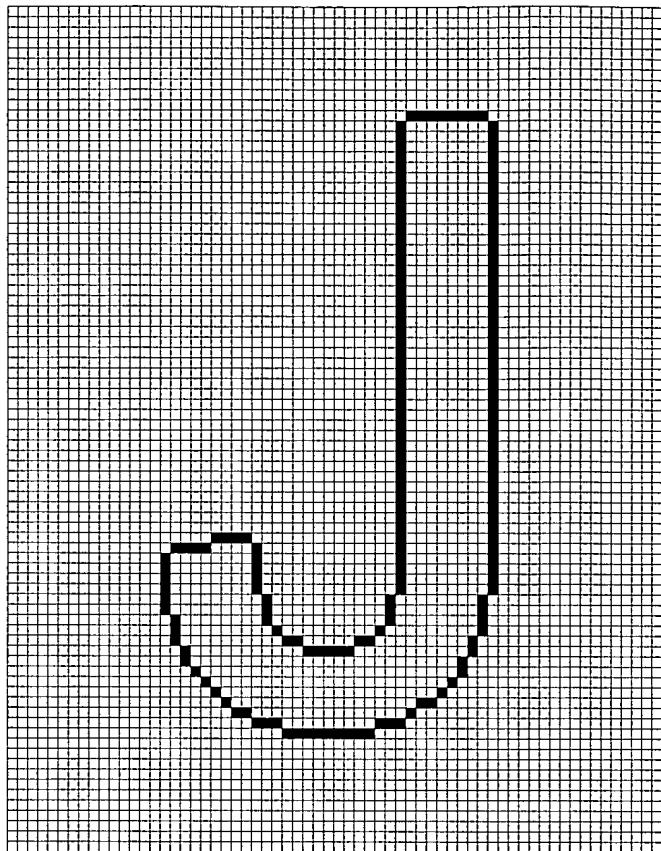Solid area density reduced
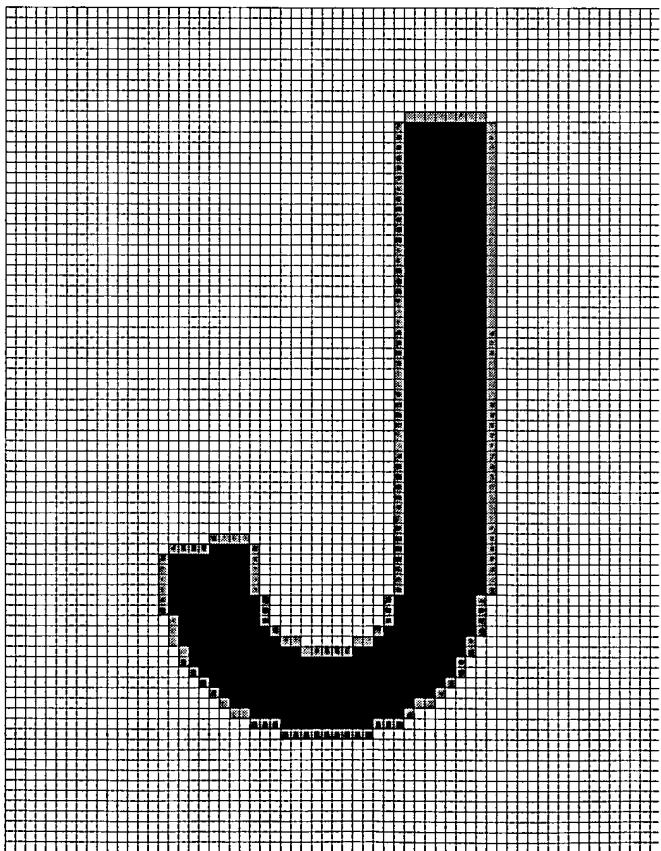Letter thinner

Fig. 6e
Edges when
thickening

Fig. 6f
Thickened
Letter thickened by
applying grey edges which
were originally white
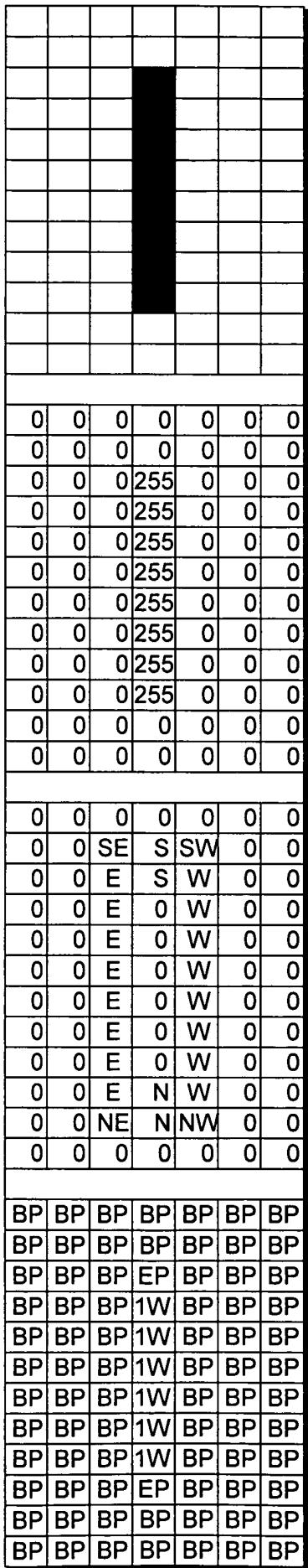
1 Pixel Wide Detection

Original 1 pixel wide line

FIG. 7a

0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

Edge Pixels

FIG. 7b

0	0	0	0	0	0	0
0	0	SE	S	SW	0	0
0	0	E	S	W	0	0
0	0	E	0	W	0	0
0	0	E	0	W	0	0
0	0	E	0	W	0	0
0	0	E	0	W	0	0
0	0	E	0	W	0	0
0	0	E	0	W	0	0
0	0	E	N	W	0	0
0	0	NE	N	NW	0	0
0	0	0	0	0	0	0

Direction Values

FIG. 7c

BP	BP	BP	BP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP
BP	BP	BP	EP	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	EP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP

Assignment
BP: Background Pixel
EP: Edge Pixel
1W: One Pixel Wide Line

FIG. 7d
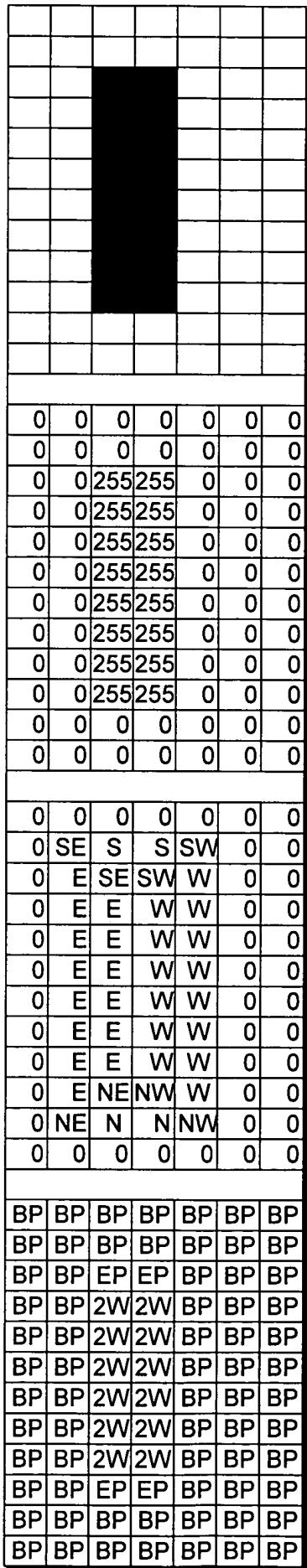
2 Pixel Wide Detection

Original 2 pixel wide line

FIG. 8a

0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

Edge Pixels

FIG. 8b

0	0	0	0	0	0	0
0	SE	S	S	SW	0	0
0	E	SE	SW	W	0	0
0	E	E	W	W	0	0
0	E	E	W	W	0	0
0	E	E	W	W	0	0
0	E	E	W	W	0	0
0	E	E	W	W	0	0
0	E	E	W	W	0	0
0	E	NE	NW	W	0	0
0	NE	N	N	NW	0	0
0	0	0	0	0	0	0

Direction Values

FIG. 8c

BP	BP	BP	BP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP
BP	BP	EP	EP	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	EP	EP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP

Assignment
BP: Background Pixel
EP: Edge Pixel
2W: Two Pixel Wide Line

FIG. 8d

Interior Pixel
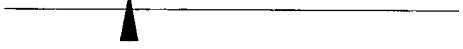
1 2 3 4 5 7 8 9 10 11 12 13 14 15 16

Edge Pixel

1 2 3 4 5 7 8 9 10 11 12 13 14 15 16

One Pixel Wide

1 2 3 4 5 7 8 9 10 11 12 13 14 15 16

Two Pixel Wide

1 2 3 4 5 7 8 9 10 11 12 13 14 15 16

Toner Consumption

1 2 3 4 5 7 8 9 10 11 12 13 14 15 16

Character Linewidth

1 2 3 4 5 7 8 9 10 11 12 13 14 15 16

Shadow

1 2 3 4 5 7 8 9 10 11 12 13 14 15 16

Asymmetry
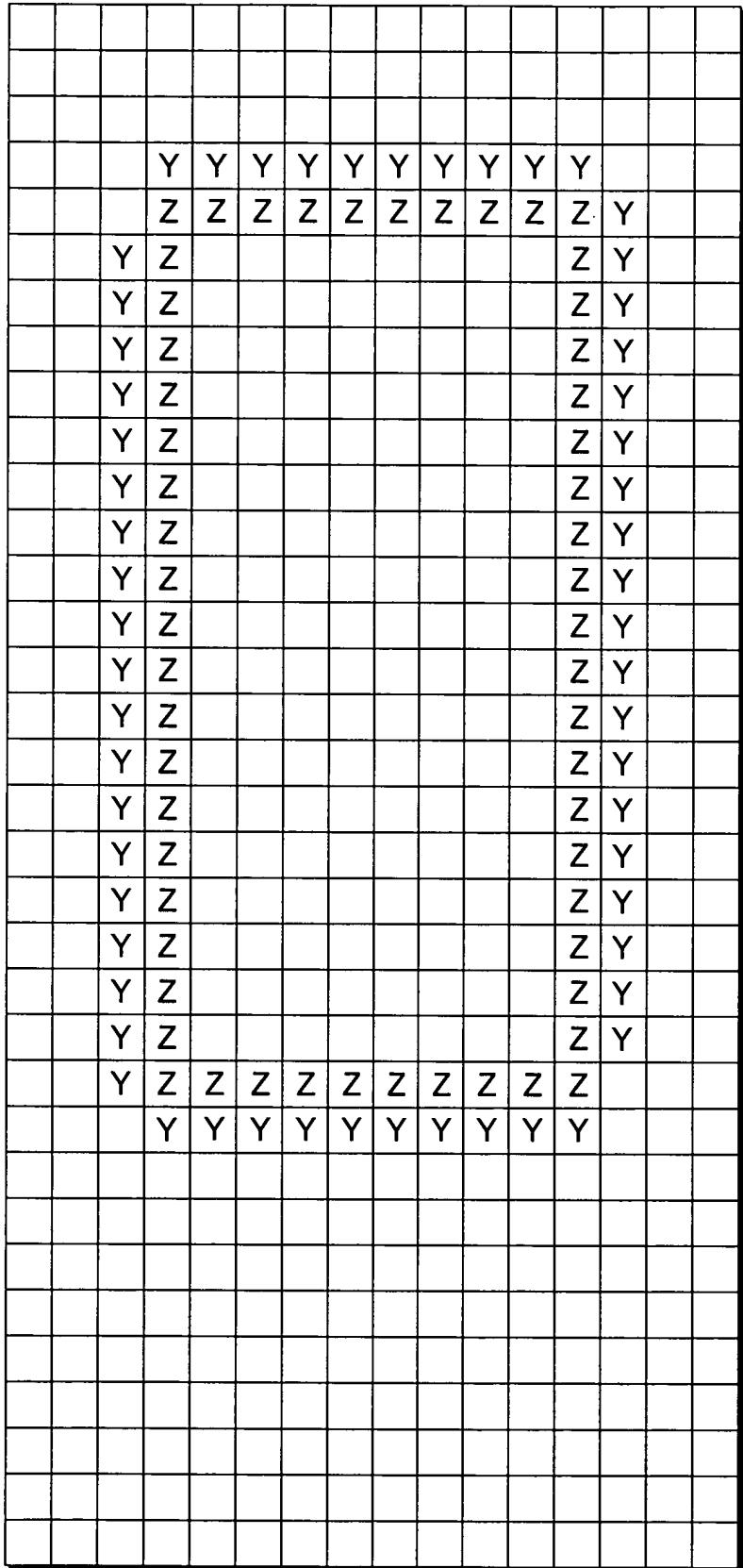
1 2 3 4 5 7 8 9 10 11 12 13 14 15 16

Exposure Modulation

1 2 3 4 5 7 8 9 10 11 12 13 14 15 16

FIG. 9

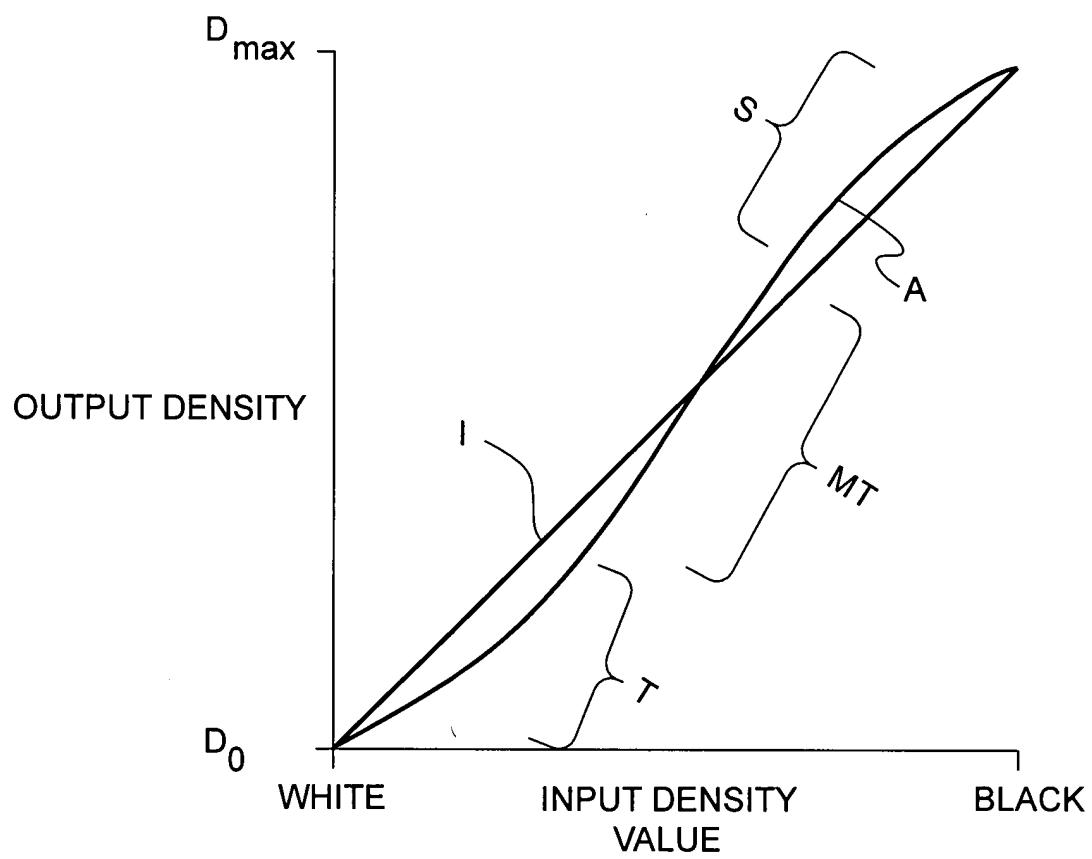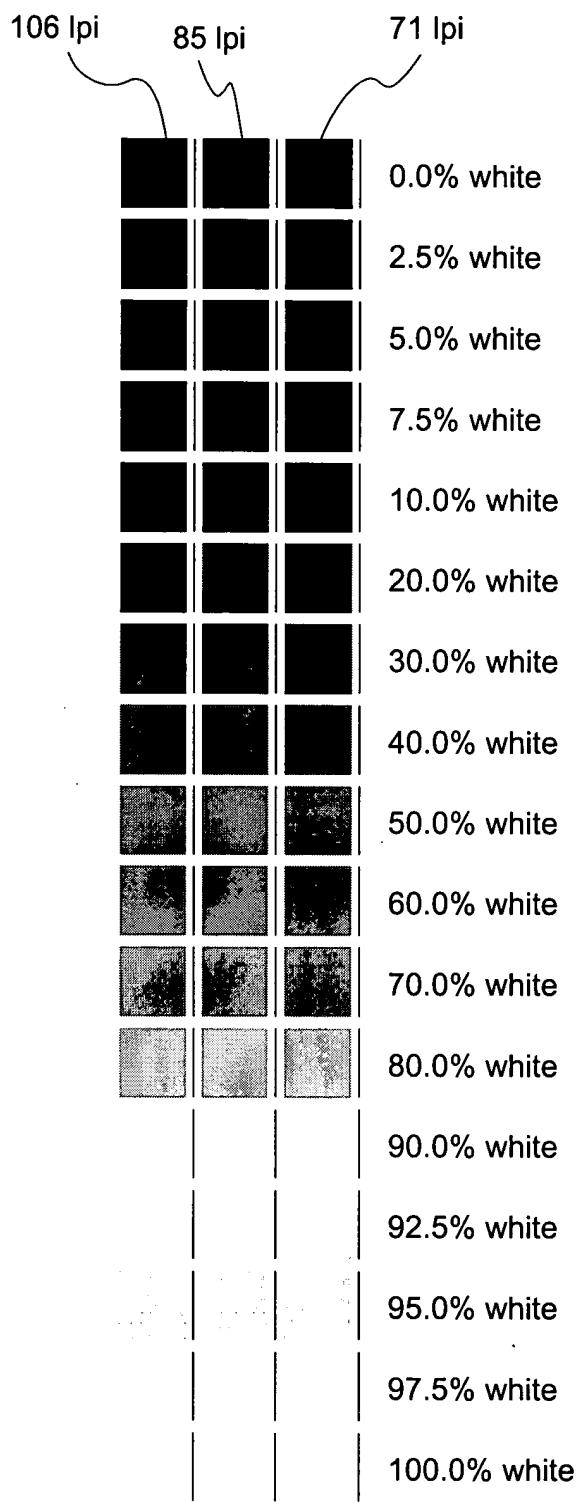|											
	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Y
Y	Z									Z	Y
Y	Z									Z	Y
Y	Z									Z	Y
Y	Z									Z	Y
Y	Z									Z	Y
Y	Z									Z	Y
Y	Z									Z	Y
Y	Z									Z	Y
Y	Z									Z	Y
Y	Z									Z	Y
Y	Z									Z	Y
Y	Z									Z	Y
Y	Z									Z	Y
Y	Z									Z	Y
Y	Z									Z	Y
Y	Z									Z	Y
Y	Z									Z	Y
Y	Z									Z	Y
Y	Z	Z	Z	Z	Z	Z	Z	Z	Z		
	Y	Y	Y	Y	Y	Y	Y	Y	Y		

FIG. 10

FIG. 11

106 lpi   85 lpi   71 lpi

0.0% white

2.5% white

5.0% white

7.5% white

10.0% white

20.0% white

30.0% white

40.0% white

50.0% white

60.0% white

70.0% white

80.0% white

90.0% white

92.5% white

95.0% white

97.5% white

100.0% white

FIG. 12

default round round
106   85   71

FIG. 13
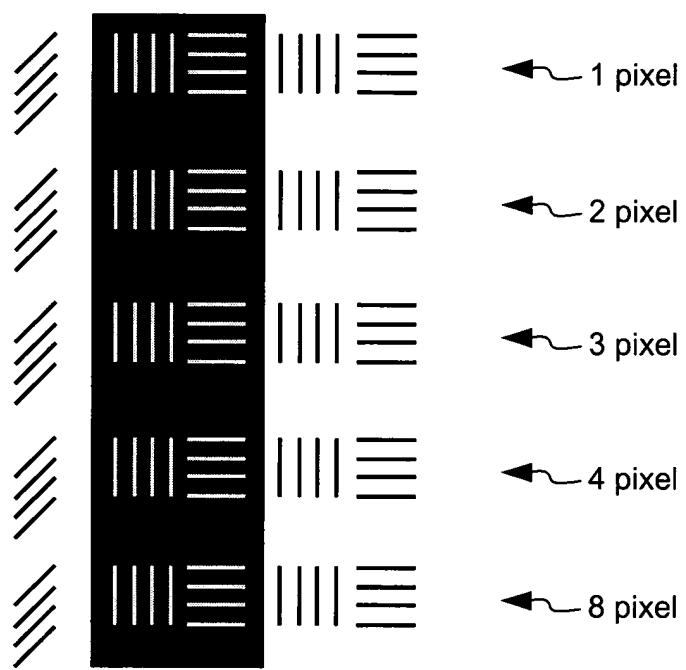
1 pixel

2 pixel

3 pixel

4 pixel

8 pixel
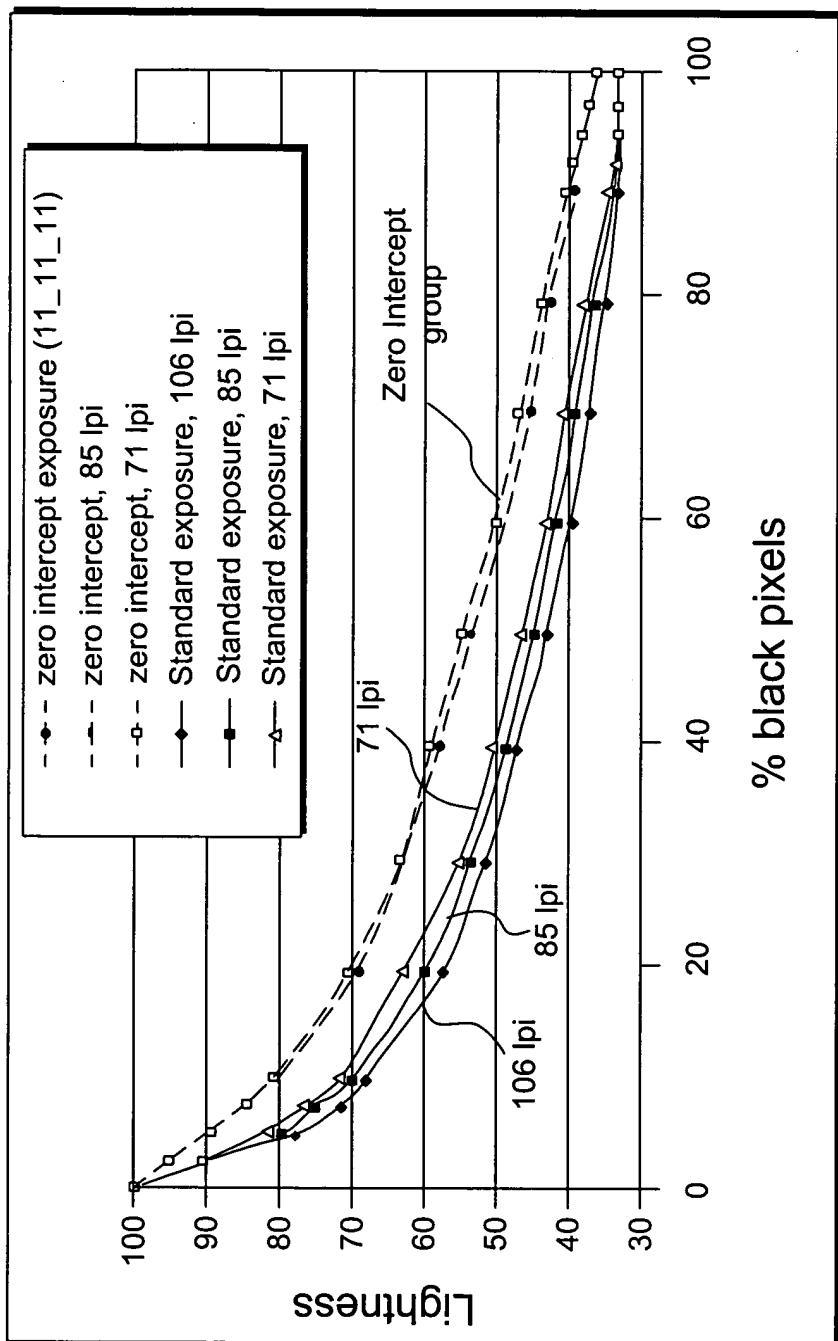
FIG. 14

FIG. 15
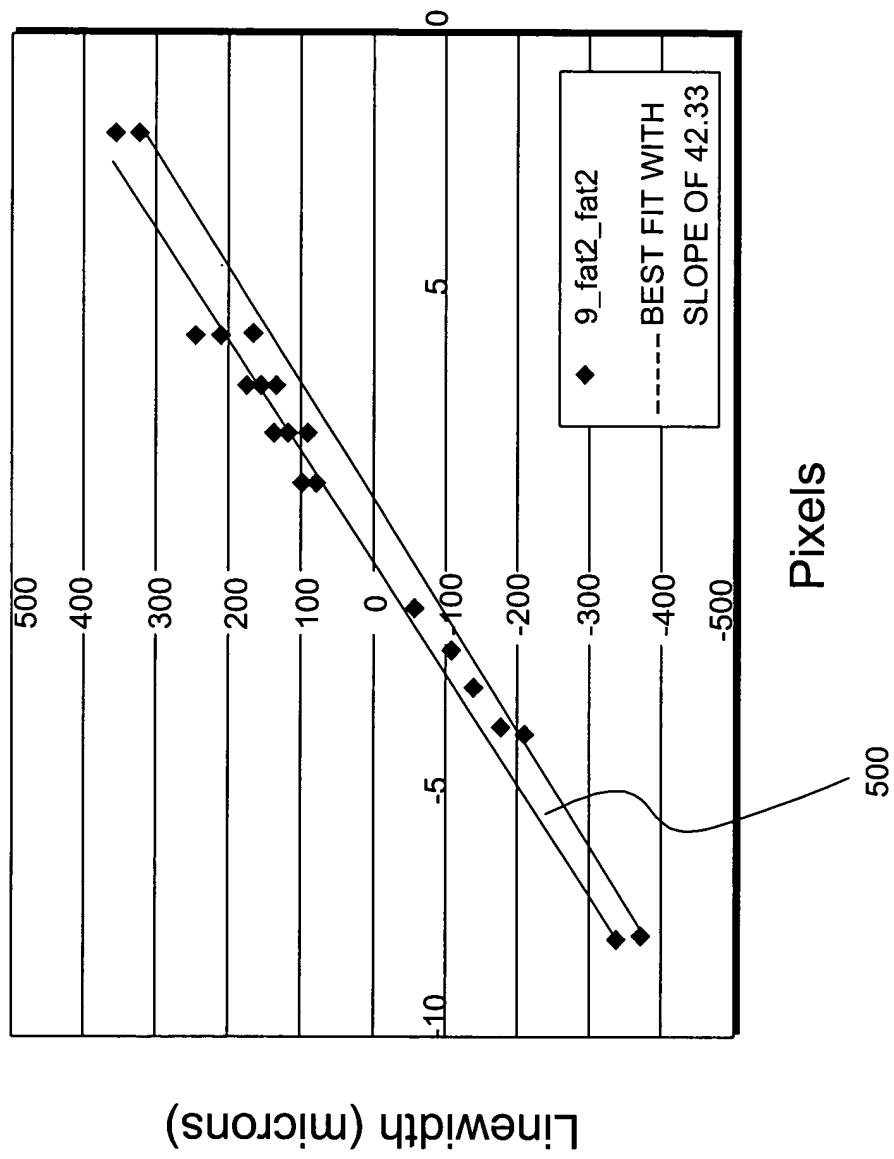
FIG. 16
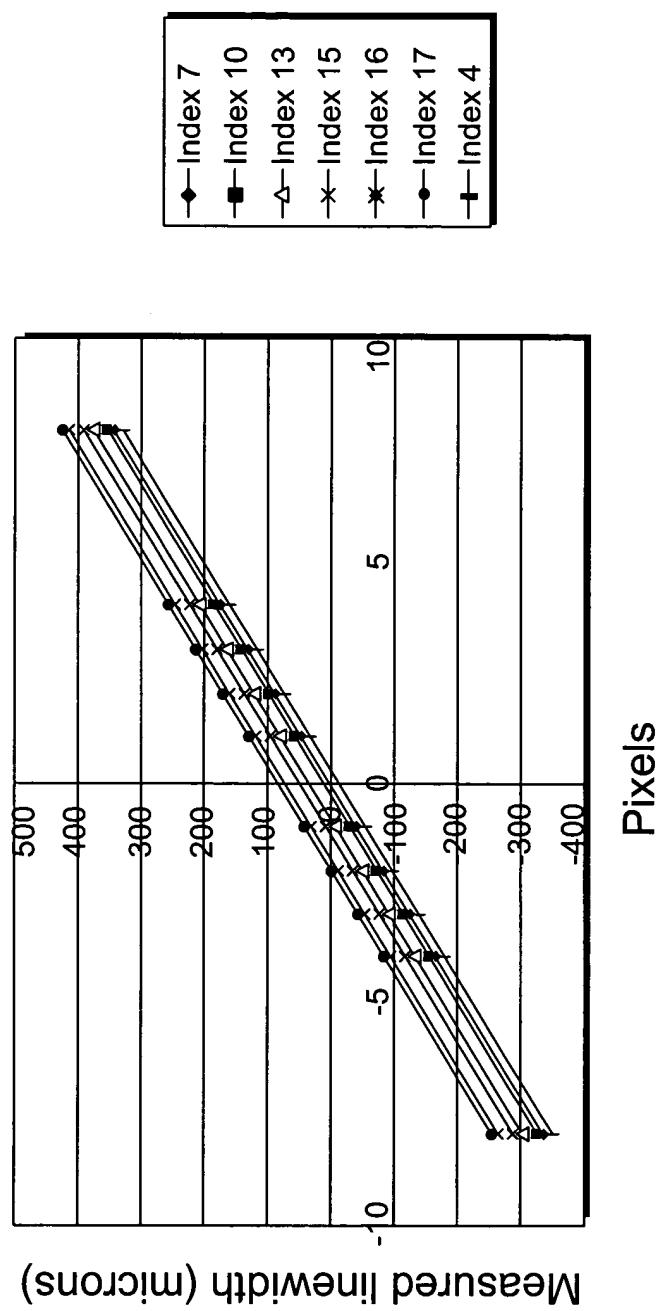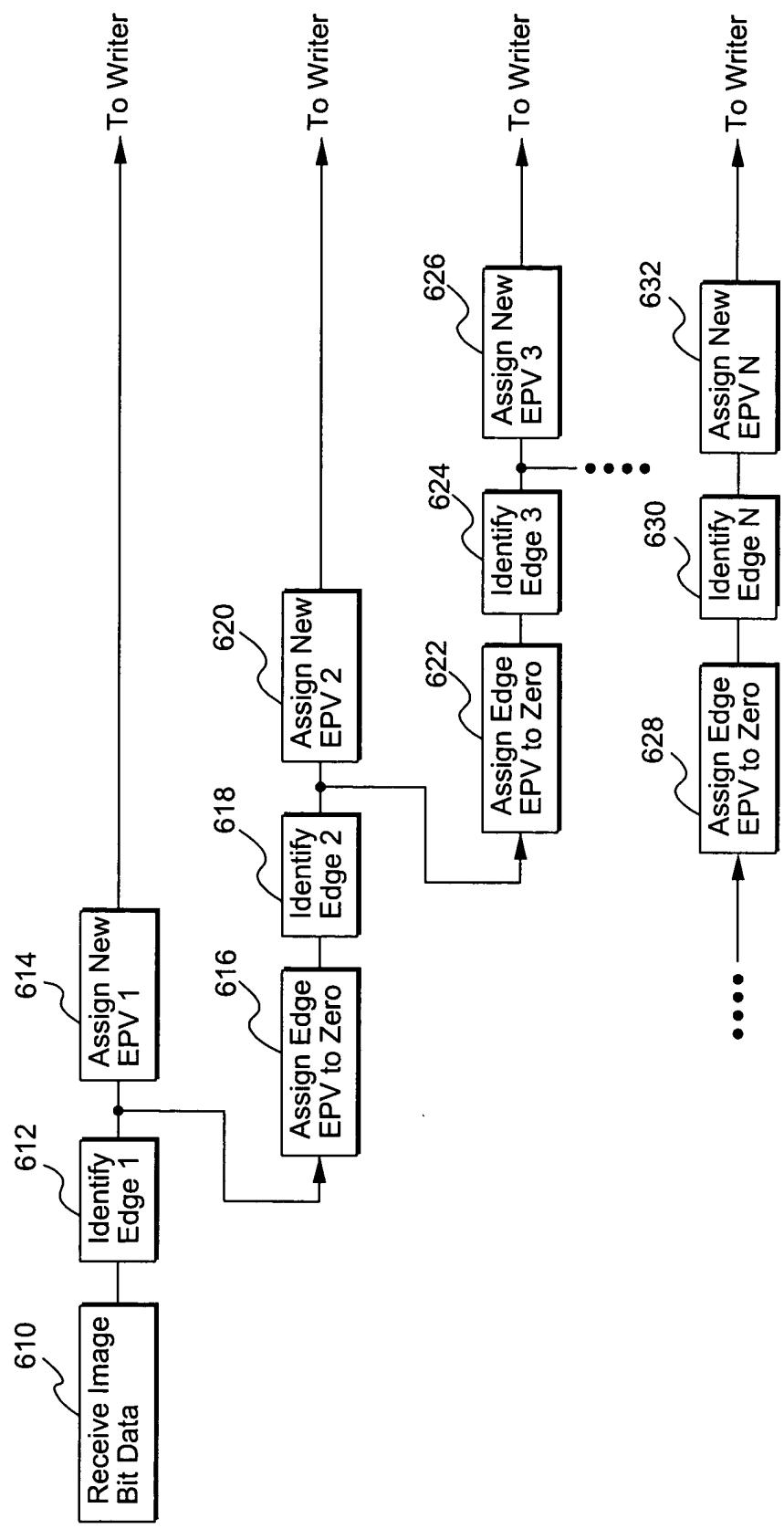
FIG. 17

FIG. 18a

b7	b6	b5
b4	PIQ	b3
b2	b1	b0

FIG. 18b

$$b_7 \quad b_6 \quad b_5 \quad b_4 \quad b_3 \quad b_2 \quad b_1 \quad b_0$$
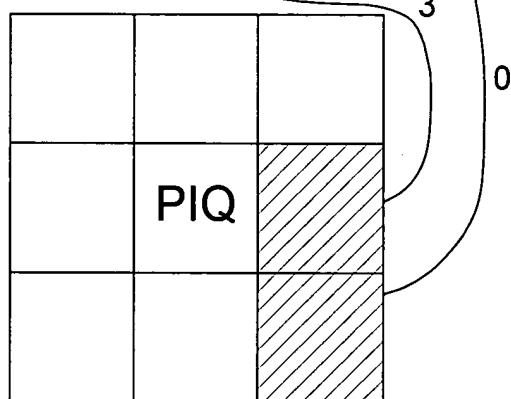
FIG. 18c

$\underline{0\ 0\ 0\ 0\ 1\ 0\ 0\ 1}$

3

0

	PIQ	

Fig. 18d

9

0	SE	S	S	SW	S	S	S	E	E	SE	SE	SE	SE	S	SE
W	SW	SW	S	W	SW	SW	SW	0	SE	S	S	SW	S	S	S
NE	E	SE	SE	0	SE	S	S	E	E	E	SE	E	E	SE	SE
NW	0	SW	S	W	SW	SW	S	NE	E	SE	SE	0	SE	S	S
N	NE	0	SE	NW	0	SW	S	NE	E	E	E	NE	E	SE	SE
NW	NW	W	SW	W	W	W	SW	N	NE	0	SE	NW	0	SW	S
N	NE	NE	E	N	NE	0	SE	NE	NE	E	E	NE	E	E	E
N	N	NW	0	NW	NW	W	SW	N	NE	NE	E	N	NE	0	SE
NW	0	SW	S	W	SW	SW	S	NE	E	SE	SE	0	SE	S	S
W	W	W	SW	W	W	SW	SW	NW	0	SW	S	W	SW	SW	S
N	NE	0	SE	NW	0	SW	S	NE	E	E	E	NE	E	SE	SE
NW	NW	W	SW	W	W	W	SW	N	NE	0	SE	NW	0	SW	S
N	N	NW	0	NW	NW	W	SW	N	NE	NE	E	N	NE	0	SE
NW	NW	W	W	NW	W	W	W	N	N	NW	0	NW	NW	W	SW
N	N	N	NE	N	N	NW	0	NE	NE	NE	E	N	NE	NE	E
NW	N	NW	NW	NW	NW	W	W	N	N	N	NE	N	N	NW	0